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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/053,085

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Raymond J. Gorte

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EXAMINER

WANG, EUGENIA

ART UNIT

PAPER NUMBER

1795

MAIL DATE

DELIVERY MODE

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PAPER

**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

### Office Action Summary

**Application No.**

10/053,085

**Applicant(s)**

GORTE ET AL.

**Examiner**

EUGENIA WANG

**Art Unit**

1795

**Period for Reply** -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 18 January 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☐ Claim(s) 2-19, 21-30, 55, 56, 58, 60 and 62-67 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 2-19, 21-30, 55, 56, 58, 60, and 62-67 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO/SB/08)  
Paper No(s)/Mail Date 4/21/08
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: \_\_\_\_\_

**DETAILED ACTION**

***Response to Amendment***

1. In response to the amendment received January 18, 2008:
  - a. Claims 1, 20, 54, 57, 59, and 61 have been cancelled as per Applicant's request. Claims 62-67 have been added. Claims 2-19, 21-30, 55, 56, 58, 60, and 62-67 are pending.
  - b. The previous rejection of record has been withdrawn. A new rejection has been applied, as necessitated by the amendment. Thus, the action is final.

***Claim Rejections - 35 USC § 102/103***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.

4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

2. Claim 2, 9, 10-12, 15, 16, 18, 21, 27, 30, 62, 63, 65, 66, rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over US 4812329 (Isenberg).

As to claim 62, 63, 65, 66, Isenberg teaches a solid oxide fuel cell (fig. 1, col. 2, lines 34-36). The fuel cell has an air electrode (cathode) [4] with air (oxygen) flowing to it, an oxygen ion (anion) conducting electrolyte, and a fuel electrode (anode) [6] that receives fuel (col. 2, lines 60-68). (It is noted that the electrolyte is yttria stabilized zirconia, which is an electric insulator (col. 2, lines 1-4)). The fuel electrode, although embodied to be a yttria stabilized zirconia/ nickel cermet, is not limited to the nickel-containing form (as shown in the example, col. 5, lines 65-68 to col. 6, lines 1-11). Other electronic conducting particles can be used instead of nickel, such as platinum, gold, silver, copper, iron, cobalt, and alloys thereof, as well as chromic oxide, lanthanum chromite, and lanthanum manganite (col. 3, lines 51-66). Therefore, Isenberg teaches a

fuel electrode that does not have nickel in it\*. (Please see \* for an alternate interpretation.) Additionally, Isenberg teaches that the fuel electrode is porous and is impregnated with cerium nitrate, which results in a porous fuel electrode with ceria ( $(\text{CeO}_2)_{0.8}(\text{La}_2\text{O})_{0.2}$ ) impregnated in the porous electrode (col. 6, lines 12-43). It is also stated that the conductor particles are bound to the electrolyte, thus showing that the like particles of the electrolyte and anode are bound together via the conductor (col. 3, lines 67-68, col. 4, lines 1-2). (In the example yttria stabilized zirconia was deposited on the conductor to attach it to the electrolyte (which is yttria stabilized zirconia as well) is deposited on top of the nickel to mechanically attach it to the electrolyte.) Lastly, Isenberg embodies a fuel with 50 ppm hydrogen sulfide in it (col. 2, lines 64-67; col. 7, lines 1-20). Although the example uses  $\text{H}_2$  and CO as the fuel (not a hydrocarbon) with 50 ppm hydrogen sulfide in it, other fuels, such as methane (a hydrocarbon) are embodied as well (col. 2, lines 60-67; col. 7, lines 1-20). Therefore Isenberg does teach of a hydrocarbon with hydrogen sulfide (sulfur impurity) as well. (Please see \*\* for an alternate interpretation.) (Note: 50 ppm of hydrogen sulfide is taken to be approximately 50 ppm sulfur, as the weight of the hydrogen portion in hydrogen sulfide is small and negligible.)

It is noted that the fuel cell of Isenberg inherently has a method of operation to provide electricity using the apparatus, as discussed above (as applied to claims 63 and 66), wherein the reactants are brought in contact with the fuel cell. It is further noted that the electrolyte and anode are bonded via the nickel powder layer prior to

impregnation with cerium, which is decomposed to ceria (col. 5, lines 65-68; col. 6, lines 1-27) (as applied to claim 63).

\*Alternately it can be interpreted that since Isenberg does not specifically teach an example of a solid oxide fuel cell, wherein there is no nickel in the anode (as the example uses nickel as the conductor). However, in this case, the use of other conductors besides nickel would have been obvious to one of ordinary skill in the art, as Isenberg teaches other electronic conducting particles that can be used instead of nickel, such as platinum, gold, silver, copper, iron, cobalt, and alloys thereof, as well as chromic oxide, lanthanum chromite, and lanthanum manganite (col. 3, lines 51-66). Therefore nickel and the materials listed above are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for nickel with the predictable result of it functioning in a solid oxide fuel cell anode as a conductor.

\*\*Alternately, it can be interpreted that since Isenberg does not specifically teach an example of a solid oxide fuel cell, wherein the sulfur impurity is in a hydrocarbon (as the example uses  $H_2$  and CO as the fuel). However, in this case, the use of other fuels would have been obvious to one of ordinary skill in the art, as Isenberg teaches other fuels that can be used instead of  $H_2$  and CO, namely methane (col. 2, lines 60-67). Therefore  $H_2$ , CO, and methane are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for fuel with the predictable result of it functioning in a solid oxide fuel cell.

As to claims 2, 9, 21, and 27, Isenberg et al. teaches that methane (a specific type of petroleum distillate) is a fuel used in the solid oxide fuel cell (col. 2, lines 64-67).

As to claims 10-12 and 30, Isenberg embodies a fuel with 50 ppm hydrogen sulfide in it (col. 2, lines 64-67; col. 7, lines 1-20). Although the example uses H<sub>2</sub> and CO as the fuel (not a hydrocarbon) with 50 ppm hydrogen sulfide in it, other fuels, such as methane (a hydrocarbon) are embodied as well (col. 2, lines 60-67; col. 7, lines 1-20). Therefore Isenberg does teach of a hydrocarbon with hydrogen sulfide (sulfur impurity) as well. (Please see \*\* for an alternate interpretation.) (Note: 50 ppm of hydrogen sulfide is taken to be approximately 50 ppm sulfur, as the weight of the hydrogen portion in hydrogen sulfide is small and negligible.)

\*\*Alternately, it can be interpreted that since Isenberg does not specifically teach an example of a solid oxide fuel cell, wherein the sulfur impurity is in a hydrocarbon (as the example uses H<sub>2</sub> and CO as the fuel). However, in this case, the use of other fuels would have been obvious to one of ordinary skill in the art, as Isenberg teaches other fuels that can be used instead of H<sub>2</sub> and CO, namely methane (col. 2, lines 60-67). Therefore H<sub>2</sub>, CO, and methane are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for fuel with the predictable result of it functioning in a solid oxide fuel cell.

As to claim 15, Isenberg's electrolyte is oxygen ion (oxide ion) conducting electrolyte (col. 2, lines 60-68).

As to claims 16 and 18, Isenberg's electrolyte is yttria stabilized zirconia (yttria-doped zirconia) (col. 2, lines 1-4).

3. Claims 3, 5-8, 22, 24-26, 28, and 29 rejected under 35 U.S.C. 103(a) as being unpatentable over Isenberg, as applied to claims 62, 2, 63, and 21, in further view US 6423896 (Keegan).

As to claims 3, 5, 6, 22, 24, 25, and 26, Isenberg does not teach the use of a petroleum distillate fuel of gasoline, diesel oil, naphtha, JP-4, JP-5, kerosene, motor oil, natural gas, fuel oil, and mixtures thereof (as required by claims 3, 5, 6, 22, 24, 25, and 26).

Keegan teaches a list of possible fuels used in a solid oxide fuel cell system (col. 1, lines 62-64). These fuels include methane (the same fuel taught by Isenberg) as well as diesel (as applied to claims 3, 22, and 26), kerosene (as applied to claims 3, 5, 22, and 24), and gasoline (as applied to claims 3, 6, 22, and 25) (col. 2, lines 43-65). Accordingly, methane, diesel, gasoline, and kerosene are all art recognized equivalents for methane for their use as fuels in solid oxide fuel cells. Furthermore, it is particularly pointed out that the combination of the conventional hydrocarbon fuels can also be combined with the simpler fuels (such as methane) (col. 2, lines 44-65). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to use diesel, kerosene, gasoline, or combinations of the aforementioned with methane as fuel (instead of methane), since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.



Furthermore, the replacement of art recognized equivalents with one another would result in the predictable result of acting in the same manner (acting as fuel).

As to claims 7, 8, 28, and 29, Isenberg does not teach the use of alcohols (as required by claims 7 and 28), namely methanol, ethanol, and mixtures thereof (as required by claims 8 and 29) as fuel.

Keegan teaches a list of possible fuels used in a solid oxide fuel cell system (col. 1, lines 62-64). These fuels include methane (embodied by Isenberg), ethanol and methanol (col. 2, lines 43-65). Accordingly, methanol and ethanol are art recognized equivalents for methane for their use as fuels in solid oxide fuel cells. Furthermore, it is particularly pointed out that the combination of the alcohol fuels (methanol and ethanol) can also be combined with the simpler fuels (such as methane) (col. 2, lines 44-65). Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to use ethanol, methanol, or either of the aforementioned with methane as fuel (instead of methane), since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, the replacement of art recognized equivalents with one another would result in the predictable result of acting in the same manner (acting as fuel).

4. Claims 4, 13, 14, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Isenberg, as applied to claims 62, 2, 10-12, 63, and 21, in view of Keegan, as applied to claims 2 and 22, in further view of US 6221280 (Anumakonda et al.).

As to claims 4 and 23, the combination of Isenberg and Keegan do not teach the use of JP-4, JP-5, JP-8, or mixtures thereof as the fuel.

However, Anumakonda et al. teach the use of heavier fuels to be used in solid oxide fuel cells, such as JP-8, JP-4, and JP-5 (abs.; col. 1, lines 10-16; col. 2, lines 38-44; col. 4, lines 5-15). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use heavier fuels (JP-8, JP-4, or JP-5) in a solid oxide fuel cell, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Note: The claim language for independent claims 62 and 63 only state that the sulfur-containing hydrocarbon fuel "does not have to undergo prior treatment." This statement does not positively limit that the sulfur-containing hydrocarbon fuel does not or cannot undergo prior treatment. Such an interpretation was applied as to the rejection above. For an alternate interpretation, see \*\*\*, below.

\*\*\* Alternately, it would have been obvious to use heavier fuels (with higher sulfur content - up to 0.3 wt% (3000 ppm) but typically between 0.05- 0.07 (500-700 ppm) (col. 2, lines 38-44)). The motivation for using fuels with jet fuels (JP-4, JP-5, JP-8) with higher sulfur content would lie in the fact hat Isenberg teaches that ceria doped anodes can withstand more sulfur impurities. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made, as one of ordinary skill in the art would have been able to appreciate using JP-8, JP-4, and JP-5 in a solid oxide fuel cell without treatment with the predictable result of the fuel cell

functioning in the same manner, since Isenberg teaches that ceria doped anodes are more sulfur tolerant.

As to claims 13 and 14, the combination of Isenberg and Keegan do not teach the use of a sulfur-containing hydrocarbon fuel with a sulfur content from about 100 - 1000 ppm (as required by claim 13) or 250-1000 ppm (as required by claim 14).

However, Anumakonda et al. teach the use of heavier fuels to be used in solid oxide fuel cells, such as JP-8, JP-4, and JP-5, wherein the aforementioned fuels have a sulfur content of about 0.05 to 0.07 wt.% (500-700 ppm) (abs.; col. 1, lines 10-16; col. 2, lines 38-44).

Motivation for using JP-8, JP-4, and JP-5 has been discussed in the rejection of claims 4 and 23 but are reiterated herein for clarity's sake.

Anumakonda et al. teach the use of heavier fuels to be used in solid oxide fuel cells, such as JP-8, JP-4, and JP-5 (wherein the aforementioned fuels have a sulfur content of about 0.05 to 0.07 wt.% (500-700 ppm)) (abs.; col. 1, lines 10-16; col. 2, lines 38-44). It would have been obvious to one having ordinary skill in the art at the time the invention was made to use heavier fuels (JP-8, JP-4, or JP-5) in a solid oxide fuel cell, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416.

Note: The claim language for independent claims 62 and 63 only state that the sulfur-containing hydrocarbon fuel "does not have to undergo prior treatment." This statement does not positively limit that the sulfur-containing hydrocarbon fuel does not

or cannot undergo prior treatment. Such an interpretation was applied as to the rejection above. For an alternate interpretation, see \*\*\*, below.

\*\*\* Alternately, it would have been obvious to use heavier fuels (with higher sulfur content - up to 0.3 wt% (3000 ppm) but typically between 0.05- 0.07 (500-700 ppm) (col. 2, lines 38-44)). The motivation for using fuels with jet fuels (JP-4, JP-5, JP-8) with higher sulfur content would lie in the fact that Isenberg teaches that ceria doped anodes can withstand more sulfur impurities. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made, as one of ordinary skill in the art would have been able to appreciate using JP-8, JP-4, and JP-5 in a solid oxide fuel cell without treatment with the predictable result of the fuel cell functioning in the same manner, since Isenberg teaches that ceria doped anodes are more sulfur tolerant.

5. Claims 17 and 19 rejected under 35 U.S.C. 103(a) as being unpatentable over Isenberg, as applied to claims 62, 15, and 16, in view of US 6017647 (Wallin).

As to claims 17 and 19, it is again stated that Isenberg teaches the use of doped zirconia for the oxide ion conducting electrolyte. Isenberg does not teach that the electrolyte is gadolinium doped ceria, samarium-doped ceria, yttria-doped ceria, and mixtures thereof (as required by claim 17) or scandium-doped zirconia (as required by claim 19).

Wallin teach a solid oxide fuel cell, wherein the ionically conductive electrolyte includes yttria-stabilized zirconia (also taught by Isenberg), scandium-doped zirconia (as applied to claim 19), gadolinium-doped ceria (as applied to claim 17) (abs; col. 4,

lines 49-59). Therefore, Wallin shows that scandium-doped zirconia, gadolinium-doped ceria, and yttria-stabilized zirconia are art recognized equivalents. Therefore it would have been obvious to one having ordinary skill in the art at the time the invention was made to use either gadolinium-doped ceria or scandium-doped zirconia as the electrolyte, since it has been held to be within the general skill of a worker in the art to select a known material on the basis of its suitability for the intended use as a matter of obvious design choice. *In re Leshin*, 125 USPQ 416. Furthermore, the replacement of art recognized equivalents with one another would result in the predictable result of acting in the same manner (oxide ion conducting).

6. Claims 55, 56, 58, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Isenberg, as applied to claims 62, 63, 65, and 66, in further view of US 5589285 (Cable et al.).

As to claims 55, 56, 58, and 60, Isenberg does not teach the addition of copper into the pores of the anode.

Cable et al. teach doping an anode with sulfur-resistance ceria, wherein an electronically conducting phase, such as copper, is added (col. 10, lines 17-31). The motivation for wanting to include copper in the ceria dopant (which would then impregnate the anode) would be to increase the electronic conductivity throughout the fuel cell and thus improve performance. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to add electronically conductive copper to ceria (as taught by Cable et al.), wherein the ceria

mixture is used to impregnate the anode for sulfur tolerance (as taught by Isenberg) in order to facilitate electronic conductivity and improve fuel cell operation.

7. Claims 64 and 67 rejected under 35 U.S.C. 103(a) as being unpatentable over Isenberg in view of Cable et al.

As to claim 64 and 67, Isenberg teaches a solid oxide fuel cell (fig. 1, col. 2, lines 34-36). The fuel cell has an air electrode (cathode) [4] with air (oxygen) flowing to it, an oxygen ion (anion) conducting electrolyte, and a fuel electrode (anode) [6] that receives fuel (col. 2, lines 60-68). (It is noted that the electrolyte is yttria stabilized zirconia, which is an electric insulator (col. 2, lines 1-4)). The fuel electrode, although embodied to be a yttria stabilized zirconia/ nickel cermet, is not limited to the nickel-containing form (as shown in the example, col. 5, lines 65-68 to col. 6, lines 1-11). Other electronic conducting particles can be used instead of nickel, such as platinum, gold, silver, copper, iron, cobalt, and alloys thereof, as well as chromic oxide, lanthanum chromite, and lanthanum manganite (col. 3, lines 51-66). Therefore, Isenberg teaches a fuel electrode that does not have nickel in it. (Please see \* for an alternate interpretation.) Additionally, Isenberg teaches that the fuel electrode is porous and is impregnated with cerium nitrate, which results in a porous fuel electrode with ceria ( $(\text{CeO}_2)_{0.8}(\text{La}_2\text{O})_{0.2}$ ) impregnated in the porous electrode (col. 6, lines 12-43). It is also stated that the conductor particles are bound to the electrolyte, thus showing that the like particles of the electrolyte and anode are bound together via the conductor (col. 3, lines 67-68, col. 4, lines 1-2). (In the example yttria stabilized zirconia was deposited on the conductor to attach it to the electrolyte (which is yttria stabilized zirconia as well) is deposited on

top of the nickel to mechanically attach it to the electrolyte.) Lastly, Isenberg embodies a fuel with 50 ppm hydrogen sulfide in it (col. 2, lines 64-67; col. 7, lines 1-20). Although the example uses  $H_2$  and CO as the fuel (not a hydrocarbon) with 50 ppm hydrogen sulfide in it, other fuels, such as methane (a hydrocarbon) are embodied as well (col. 2, lines 60-67; col. 7, lines 1-20). Therefore Isenberg does teach of a hydrocarbon with hydrogen sulfide (sulfur impurity) as well. (Please see \*\* for an alternate interpretation.) (Note: 50 ppm of hydrogen sulfide is taken to be approximately 50 ppm sulfur, as the weight of the hydrogen portion in hydrogen sulfide is small and negligible.)

It is noted that the fuel cell of Isenberg inherently has a method of operation to provide electricity using the apparatus, as discussed above (as applied to claims 63 and 66), wherein the reactants are brought in contact with the fuel cell. It is further noted that the electrolyte and anode are bonded via the nickel powder layer prior to impregnation with cerium, which is decomposed to ceria (col. 5, lines 65-68; col. 6, lines 1-27) (as applied to claim 63).

\*Alternately it can be interpreted that since Isenberg does not specifically teach an example of a solid oxide fuel cell, wherein there is no nickel in the anode (as the example uses nickel as the conductor). However, in this case, the use of other conductors besides nickel would have been obvious to one of ordinary skill in the art, as Isenberg teaches other electronic conducting particles that can be used instead of nickel, such as platinum, gold, silver, copper, iron, cobalt, and alloys thereof, as well as chromic oxide, lanthanum chromite, and lanthanum manganite (col. 3, lines 51-66). Therefore nickel and the materials listed above are art recognized equivalents, and it

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would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for nickel with the predictable result of it functioning in a solid oxide fuel cell anode as a conductor.

**\*\*Alternately, it can be interpreted that since Isenberg does not specifically teach an example of a solid oxide fuel cell, wherein the sulfur impurity is in a hydrocarbon (as the example uses  $H_2$  and CO as the fuel). However, in this case, the use of other fuels would have been obvious to one of ordinary skill in the art, as Isenberg teaches other fuels that can be used instead of  $H_2$  and CO, namely methane (col. 2, lines 60-67). Therefore  $H_2$ , CO, and methane are art recognized equivalents, and it would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for fuel with the predictable result of it functioning in a solid oxide fuel cell.**

Isenberg does not teach the addition of copper into the pores of the anode.

Cable et al. teach doping an anode with sulfur-resistance ceria, wherein an electronically conducting phase, such as copper, is added (col. 10, lines 17-31). The motivation for wanting to include copper in the ceria dopant (which would then impregnate the anode) would be to increase the electronic conductivity throughout the fuel cell and thus improve performance. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to add electronically conductive copper to ceria (as taught by Cable et al.), wherein the ceria mixture is used to impregnate the anode for sulfur tolerance (as taught by Isenberg) in order to facilitate electronic conductivity and improve fuel cell operation.



(Note: Although claim 64 includes the claim language that a copper salt is used to deposit copper into the pores of the anode, this is product by process limitation, wherein the production of Isenberg combined with Cable et al. would teach of in the pores of the anode, thus being the same as the claimed invention. Process limitations are not given weight with regards to the product as long as the product is the same of that of the claimed invention.

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process." In re Thorpe, 777 F.2d, 698, 227 USPQ 964, 966 (Fed. Cir. 1985)(citations omitted).

"The Patent Office bears a lesser burden of proof in making out a case of prima facie obviousness for product-by-process claims because of their peculiar nature" than when a product is claimed in the conventional fashion. In re Fessmann, 489 F.2d 742, 744, 180 USPQ 324, 326 (CCPA 1974). Once the Examiner provides a rationale tending to show that the claimed product appears to be the same or similar to that of the prior art, although produced by a different process, the burden shifts to applicant to come forward with evidence establishing an unobvious difference between the claimed product and the prior art product. In re Marosi, 710 F.2d 798, 802, 218 USPQ 289, 292 (Fed. Cir. 1983). Ex parte Gray, 10 USPQ2d 1922 (Bd. Pat. App. & Inter. 1989). See MPEP section 2113.)

***Response to Arguments***

8. Applicant's arguments with respect to claims 2-19, 21-30, 55, 56, 58, 60, and 62-67 have been considered but are moot in view of the new ground(s) of rejection.

However, Examiner would like to take the opportunity to address the pertinent arguments applied to the prior art.

Applicant argues that Isenberg does not cure the deficiencies of Wallin (namely that the anode is essentially nickel-free.)

Examiner respectfully disagrees. Isenberg teaches a solid oxide fuel cell. The fuel electrode, although embodied to be a yttria stabilized zirconia/ nickel cermet, is not limited to the nickel-containing form (as shown in the example, col. 5, lines 65-68 to col. 6, lines 1-11). Other electronic conducting particles can be used instead of nickel, such as platinum, gold, silver, copper, iron, cobalt, and alloys thereof, as well as chromic oxide, lanthanum chromite, and lanthanum manganite (col. 3, lines 51-66). Therefore, Isenberg teaches a fuel electrode that does not have nickel in it.

Alternately it can be interpreted that since Isenberg does not specifically teach an example of a solid oxide fuel cell, wherein there is no nickel in the anode (as the example uses nickel as the conductor). However, in this case, the use of other conductors besides nickel would have been obvious to one of ordinary skill in the art, as Isenberg teaches other electronic conducting particles that can be used instead of nickel, such as platinum, gold, silver, copper, iron, cobalt, and alloys thereof, as well as chromic oxide, lanthanum chromite, and lanthanum manganite (col. 3, lines 51-66). Therefore nickel and the materials listed above are art recognized equivalents, and it

would have been obvious to one of ordinary skill in the art at the time the invention was made to substitute any of the art recognized equivalents for nickel with the predictable result of it functioning in a solid oxide fuel cell anode as a conductor.

For the reasons listed above, Examiner's position is maintained that Isenberg does teach of a nickel-free anode.

Applicant argues that the combination of Anumakonda et al. is not combinable, since it includes reforming of the high sulfur containing fuel.

Examiner respectfully disagrees with Applicant's position. The claim language for independent claims 62-64 only state that the sulfur-containing hydrocarbon fuel "does not have to undergo prior treatment." This statement does not positively limit that the sulfur-containing hydrocarbon fuel does not or cannot undergo prior treatment.

Alternately, it would have been obvious to use heavier fuels (with higher sulfur content - up to 0.3 wt% (3000 ppm) but typically between 0.05- 0.07 (500-700 ppm) (col. 2, lines 38-44)). The motivation for using fuels with jet fuels (JP-4, JP-5, JP-8) with higher sulfur content would lie in the fact hat Isenberg teaches that ceria doped anodes can withstand more sulfur impurities. Therefore it would have been obvious to one having ordinary skill in the art at the time the claimed invention was made, as one of ordinary skill in the art would have been able to appreciate using JP-8, JP-4, and JP-5 in a solid oxide fuel cell without treatment with the predictable result of the fuel cell functioning in the same manner, since Isenberg teaches that ceria doped anodes are more sulfur tolerant.

For the reasons listed above, Examiner's position is that Anumakonda et al. is combinable with Isenberg (in view of Keegan).

Applicant argues that CH<sub>4</sub> and alcohols are not functionally equivalent hydrocarbon fuels. Applicant cites journal arguments to show how the reactions are different.

Examiner respectfully disagrees. As taught by Keegan, methane as well as alcohols (methanol and ethanol) are all taught as fuels that can be used (col. 2, lines 44-65). Although their reaction mechanism are different (as expected, since they are different compositions), it does not negate the fact that they are all known fuels that can be used in a solid oxide fuel cell. Furthermore, it is particularly pointed out that the combination of the alcohol fuels (methanol and ethanol) can also be combined with the simpler fuels (such as methane) (col. 2, lines 44-65). Accordingly, Examiner is unsure how Keegan et al. does not teach of the use of methanol/ethanol for use in the fuel cell.

Again Applicant argues that their fuel does not have to be reformed.

Examiner would like to reiterate that claim language for independent claims 62-64 only state that the sulfur-containing hydrocarbon fuel "does not have to undergo prior treatment." This statement does not positively limit that the sulfur-containing hydrocarbon fuel does not or cannot undergo prior treatment.

Applicant argues that one would not be motivated to combine Cable et al. with Wallin/Isenberg. (Examiner will deal with this argument as if being applied to Cable et al. combined with Isenberg, as Wallin is no longer used in the combination.) In particular, Applicant argues that the combination would not provide sulfur tolerance.

Examiner respectfully disagrees. As set forth above, both Cable et al. and Isenberg deal with sulfur tolerance. Isenberg uses ceria, and Cable et al. uses ceria and copper. Copper would help facilitate electronic conductivity (as set forth in the rejection in section 7). There is no proof that combining Cable et al. and Isenberg do not teach of sulfur tolerance, as both pieces deal with sulfur tolerance. For the reasons set forth, Examiner's position is maintained.

### ***Conclusion***

9. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to **EUGENIA WANG** whose telephone number is (571)272-4942. The examiner can normally be reached on 7 - 4:30 Mon. - Thurs., EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan can be reached on 571-272-1292. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/E. W./  
Examiner, Art Unit 1795

/Gregg Cantelmo/  
for E. Wang, Examiner of Art Unit 1795